

Planetary Vacuum Cleaner for Venus and Mars, Phase I

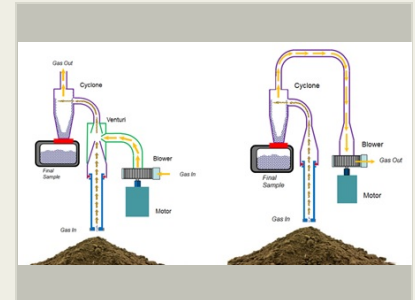
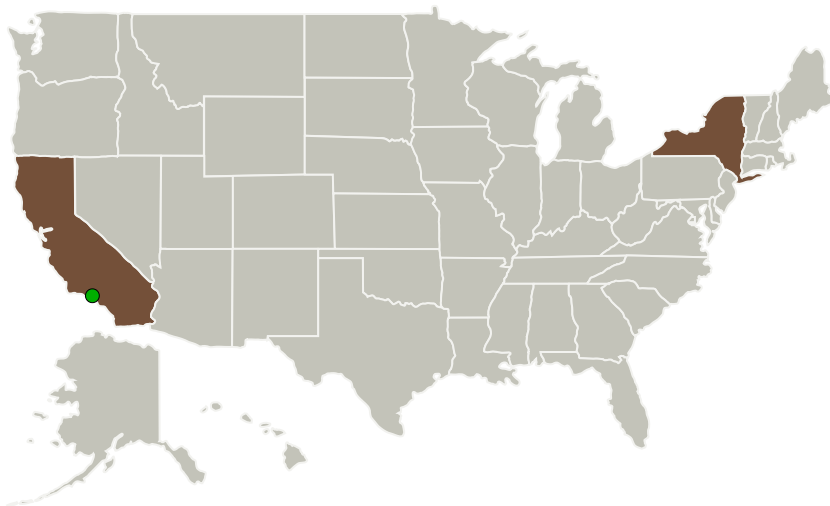
Completed Technology Project (2016 - 2016)



Project Introduction

The majority of planetary bodies of interest to exploration are covered with a layer of granular material called regolith. These bodies include the Moon, Mercury, Venus, Mars, Asteroids, Comets and moons of Mars, Jupiter, Uranus, and Neptune. Surface missions to these bodies, would most probably require some type of a sampling system to capture samples and deliver them to in-situ instruments or sample return containers. Honeybee Robotics, therefore, proposes to develop a robust on-demand sample acquisition and delivery system enabled by a high efficiency blower. The system will be akin to conventional vacuum cleaners on Earth, but adapted for Venus conditions. As such, the main technology areas will include development of the following four subsystems: Blower, Cyclone, Nozzle and Tubing; with the Blower being most critical. The target mission will be Venus In Situ Explorer (VISE), however, the technology could be adopted to Mars missions. We will use CFD FLUENT to perform blower and cyclone analysis simulating Venus' atmosphere and gravity, as gravity affects cyclone performance. We will fabricate and test a blower under relevant pressure conditions in a high pressure chamber. We will also fabricate a cyclone and suction tubes. The system will be assembled to allow end to end testing. Further, we will develop a TRL 5/6 design for the pneumatic system, which would be fabricated and tested in Phase 2

Primary U.S. Work Locations and Key Partners



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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Completed Technology Project (2016 - 2016)



Organizations Performing Work	Role	Type	Location
Honeybee Robotics, Ltd.	Lead Organization	Industry	Pasadena, California
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	New York

Project Transitions

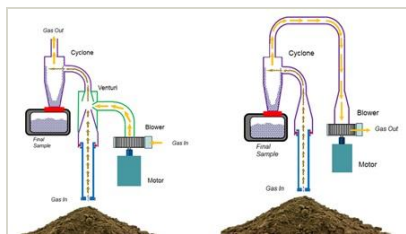
▶ **June 2016:** Project Start

✓ **December 2016:** Closed out

Closeout Documentation:

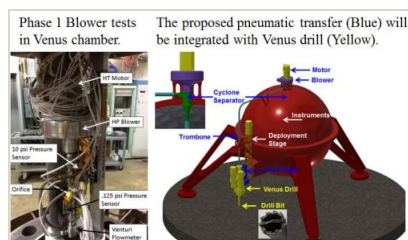
- Final Summary Chart(<https://techport.nasa.gov/file/139687>)

Images



Briefing Chart Image

Planetary Vacuum Cleaner for Venus and Mars, Phase I
(<https://techport.nasa.gov/image/136901>)



Final Summary Chart Image

Planetary Vacuum Cleaner for Venus and Mars, Phase I Project Image
(<https://techport.nasa.gov/image/129154>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Honeybee Robotics, Ltd.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

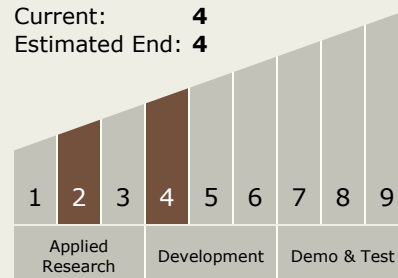
Carlos Torrez

Principal Investigator:

Kris Zacny

Technology Maturity (TRL)

Start: 2
Current: 4
Estimated End: 4



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Technology Areas

Primary:

- TX04 Robotic Systems
 - └ TX04.3 Manipulation
 - └ TX04.3.2 Grappling Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System